

Speedy analyzer ensures safe use of jet fuels

by Sarah Hubbard, Propulsion Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The Air Force Research Laboratory Fuels Branch has developed a new tool that analyzes jet fuel within five minutes and estimates important properties in a mobile laboratory setting.

The fast gas chromatograph, or GC, is an instrument that examines different types of fuels by separating the complex petroleum mixtures and determines whether or not they are safe for military use. According to Rich Striebich, chemical research engineer in the fuels branch and contractor at the University of Dayton Research Institute, the GC creates a very accurate “fingerprint” depiction of each fuel type.

The parts of the fast gas chromatograph include the oven, column, injector, flame-ionization detector, auto sampler and gas generators, which make the system portable. There are separate gas generators for hydrogen, air, and the main carrier gas, nitrogen. Water is also an important component in the process because electrolysis, the splitting of water into hydrogen and oxygen by electricity, is used to obtain the hydrogen gas used in the GC.

The GC process is both fast and simple, Striebich said. Samples of fuels are placed in a computer-controlled auto sampler which then grabs the bottle containing that fuel and places it under a syringe that extracts the fuel. The fuel in the syringe is then injected into a glass tube, the inside of which is slightly larger than a human hair. According to Striebich, the smaller the dimensions of the tube, the faster the analysis.

The fuel then separates inside the tube into its volatile and non-volatile components. A volatile substance is one prone to evaporation. The most volatile components come out of the process first and the least volatile ones last.

From this process, a gas chromatogram is formed. The chromatogram can then be related to various properties of fuel. To date, freezing point, flash point, sulfur content and distillation range have been used. Different features of the fingerprint chromatograms are important in predicting these four important properties.

“Our goal in this project was to create a GC that would run faster than a standard GC, which takes about 1-2 hours, and that can be field-deployable,” Striebich said. “In Operation Iraqi Freedom, fuel is being obtained from European countries and often has to be tested for what type of fuel it is and what quality it is. There is no time to have it shipped to a regional lab to be specification-tested, so we realized the need for something field-deployable and fast to ultimately help the warfighter. The new GC can run and obtain specification estimates in only 5 minutes and should be out in the field soon.”

The GC is also relatively inexpensive, at an estimated \$35,000 per instrument, Striebich said.

“We had a great team of engineers consisting of government, contractor and top undergraduate students from UD working on the instrument, which was proposed and made operational in less than 1 year,” Striebich said.

The Fast Gas Chromatography system is about to be deployed overseas and will help to keep aircraft and other systems operating safely and efficiently. @